Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5147816051

maTh EmaTICs **0580/43**

Paper 4 (Extended) **may/June 2016**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator
Tracing paper (optional).
Geometrical instruments

REa D Th Es E INs TRUCTIONs FIRs T

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 130.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **15** printed pages and **1** blank page.

1 A football club sells tickets at different prices dependent on age group.

(a) (i) At one game, the club sold tickets in the ratio

under 18 : 18 to 60 : over 60 = 2 : 7 : 3.

There were 6100 tickets sold for people aged under 18.

Calculate the **total** number of tickets sold for the game.

..... [3]

(ii) Calculate the percentage of tickets sold for people aged under 18.

.....% [1]

(b) The table shows the football ticket prices for the different age groups.

Age	Price
Under 18	\$15
18 to 60	\$35
Over 60	\$18

At a **different** game there were 42 600 tickets sold.

- 14% were sold to people aged under 18
- $\frac{2}{3}$ of the tickets were sold to people aged 18 to 60
- The remainder were sold to people aged over 60

Calculate the total amount the football club receives from ticket sales for this game.

\$ ..... [5]

(c) In a sale, the football club shop reduced the price of the football shirts to \$23.80 .
An error was made when working out this sale price.
The price was reduced by 30% instead of 20%.

Calculate the correct sale price for the football shirt.

\$..... [5]

2 **(a)** Solve the inequality.

$$5x - 3 > 9$$

..... [2]

(b) Factorise completely.

(i) $xy - 18 + 3y - 6x$

..... [2]

(ii) $8x^2 - 72y^2$

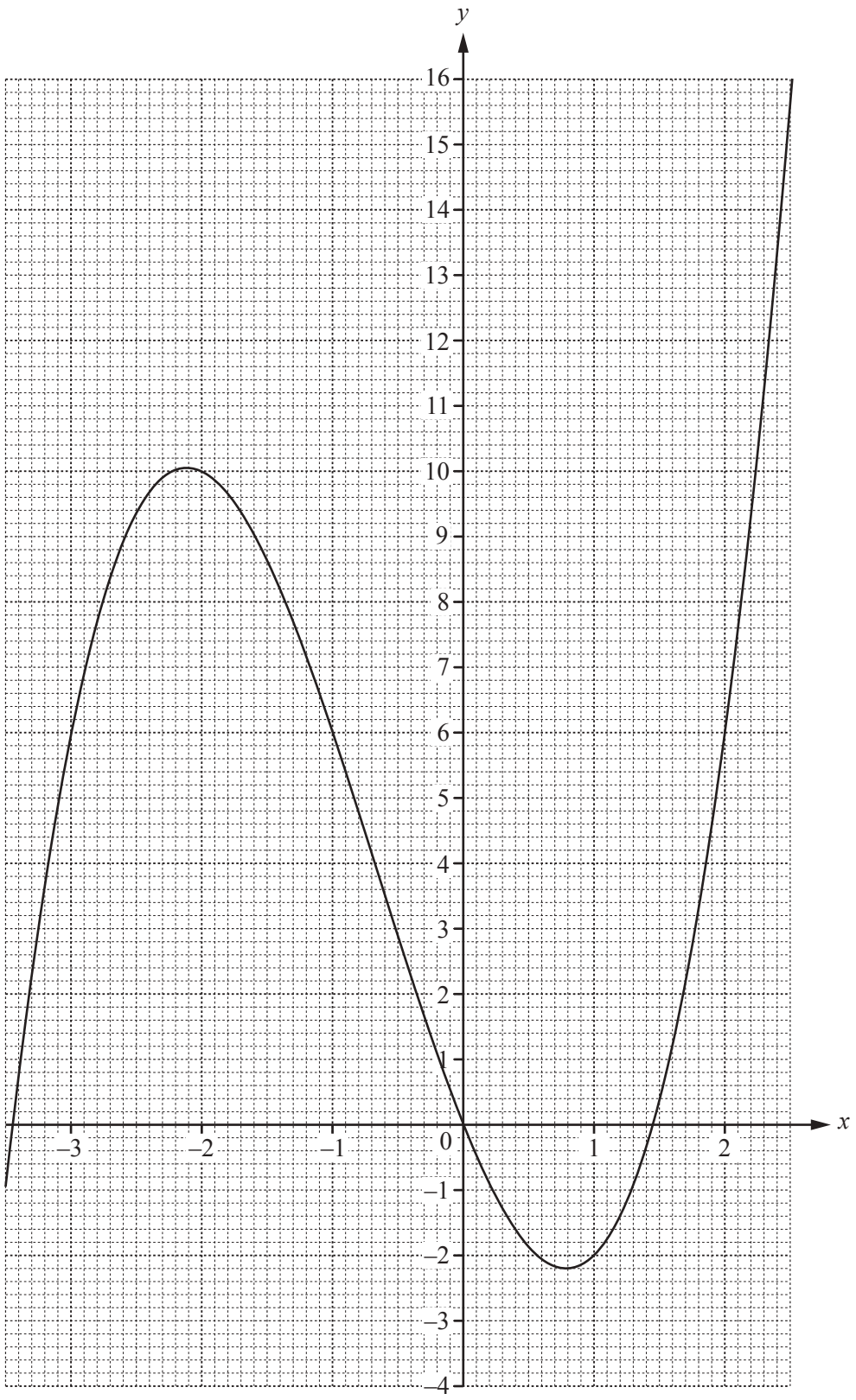
..... [3]

(c) Make r the subject of the formula.

$$p + 5 = \frac{1 - 2r}{r}$$

$r =$ ..... [4]

3 The diagram shows the graph of $y = f(x)$ for $-3.5 \leqslant x \leqslant 2.5$.



(a) (i) Find f(– 2).

..... [1]

(ii) Solve the equation f(x) = 2.

x = ... or x = ... or x = ...[3]

(iii) Two tangents, each with gradient 0, can be drawn to the graph of y = f(x).

Write down the equation of each tangent.

.....

..... [2]

(b) (i) Complete the table for $g(x) = \frac{2}{x} + 3$ for $-3.5 \leqslant x \leqslant -0.5$ and $0.5 \leqslant x \leqslant 2.5$.

x	–3.5	–3	–2	–1	–0.5		0.5	1	2	2.5
g(x)	2.4	2.3		1			7	5		3.8

[3]

(ii) On the grid opposite, draw the graph of y = g(x). [4]

(iii) Use your graph to solve the equation f(x) = g(x).

x = ... or x = ...[2]

(c) Find gf(–2).

..... [2]

(d) Find $g^{-1}(5)$.

..... [1]

4 Coins are put into a machine to pay for parking cars.
The probability that the machine rejects a coin is 0.05 .

(a) Adhira puts 2 coins into the machine.

(i) Calculate the probability that the machine rejects **both** coins.

..... [2]

(ii) Calculate the probability that the machine accepts at **least one** coin.

..... [1]

(b) Raj puts 4 coins into the machine.

Calculate the probability that the machine rejects **exactly one** coin.

..... [3]

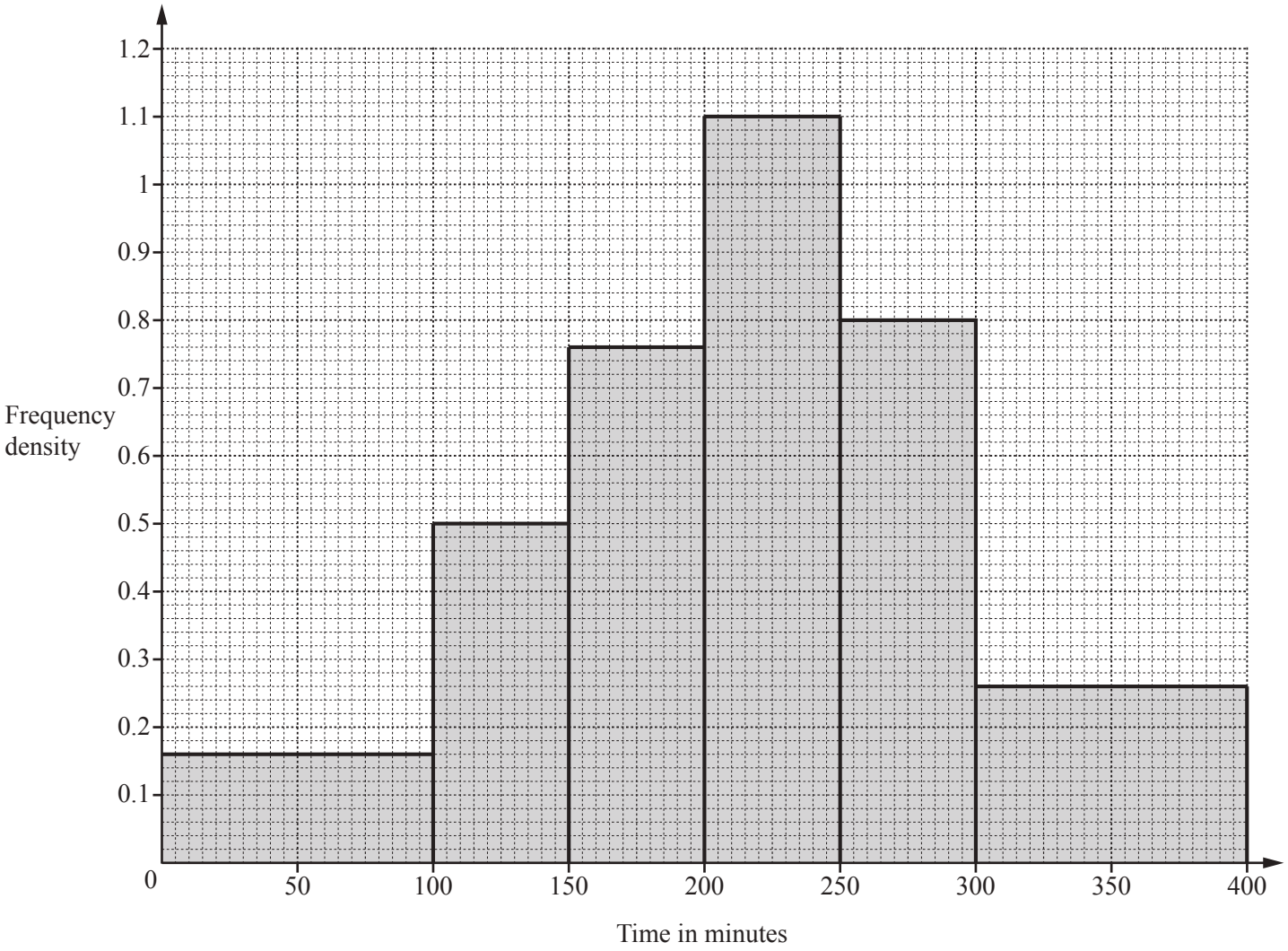
(c) The table shows the amount of money, $\$a$, received for parking each day for 200 days.

Amount ($\$a$)	$200 < a \leqslant 250$	$250 < a \leqslant 300$	$300 < a \leqslant 350$	$350 < a \leqslant 400$	$400 < a \leqslant 450$	$450 < a \leqslant 500$
Frequency	13	19	27	56	62	23

Calculate an estimate of the mean amount of money received each day.

$..... [4]

(d) The histogram shows the length of time that 200 cars were parked.



(i) Calculate the number of cars that were parked for 100 minutes or less.

..... [1]

(ii) Calculate the percentage of cars that were parked for more than 250 minutes.

.....% [2]

5

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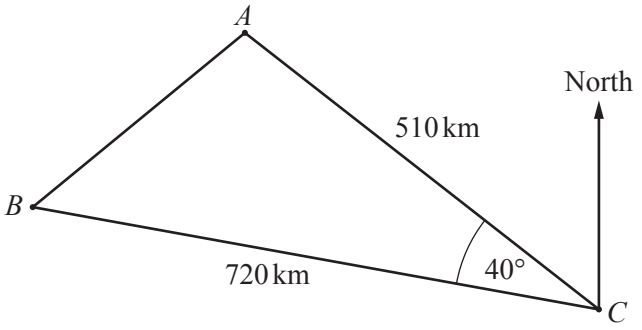


A plane flies from A to C and then from C to B.
$AC = 510$ km and $CB = 720$ km.
The bearing of C from A is 135° and angle $ACB = 40°$.

(a) Find the bearing of

(i) B from C,

..... [2]

(ii) C from B.

..... [2]

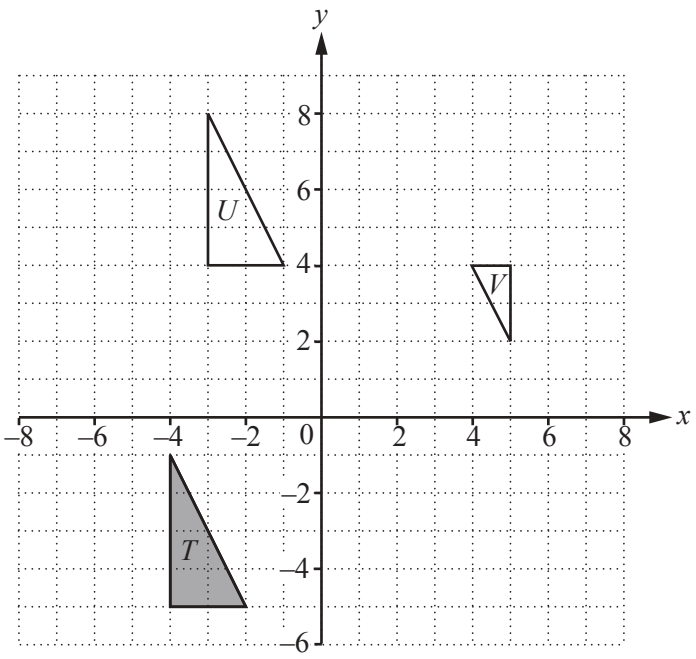
(b) Calculate AB and show that it rounds to 464.7 km, correct to 1 decimal place.

[4]

(c) Calculate angle ABC.

Angle ABC = ... [3]

6



(a) (i) Draw the image of triangle T after a reflection in the line $x = 0$. [2]

(ii) Draw the image of triangle T after a rotation through 90° clockwise about (–2, –1). [2]

(iii) Describe fully the **single** transformation that maps triangle T onto triangle U.

.....

..... [2]

(iv) Describe fully the **single** transformation that maps triangle T onto triangle V.

.....

..... [3]

(b) (i) Find the matrix that represents the transformation in **part (a)(i)**.

$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(ii) Describe fully the **single** transformation represented by the inverse of the matrix in **part (b)(i)**.

.....

..... [2]

7 Alfonso runs 10 km at an average speed of x km/h.
The next day he runs 12 km at an average speed of $(x - 1)$ km/h.

The time taken for the 10 km run is 30 minutes less than the time taken for the 12 km run.

(a) (i) Write down an equation in x and show that it simplifies to $x^2 - 5x - 20 = 0$.

[4]

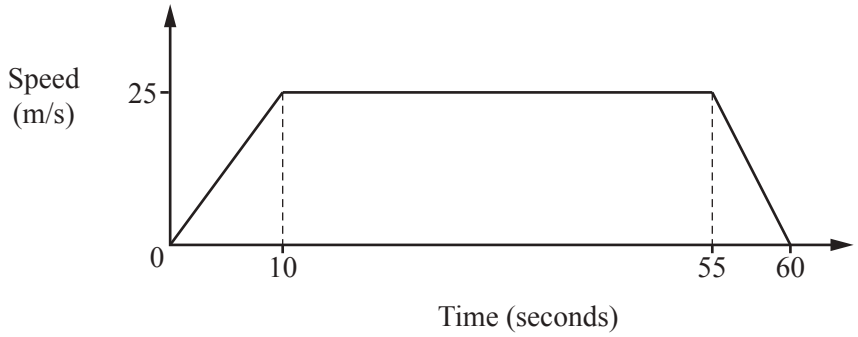
(ii) Use the quadratic formula to solve the equation $x^2 - 5x - 20 = 0$.
Show your working and give your answers correct to 2 decimal places.

$x =$ ..... or $x =$ ..... [4]

(iii) Find the time that Alfonso takes to complete the 12 km run.
Give your answer in hours and minutes correct to the nearest minute.

..... hours ..... minutes [2]

(b) A cheetah runs for 60 seconds.
The diagram shows the speed-time graph.



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(i) Work out the acceleration of the cheetah during the first 10 seconds.

..... m/s^2 [1]

(ii) Calculate the distance travelled by the cheetah.

..... m [3]

8 $\mathbf{A} = \begin{pmatrix} 2 & 0 \\ -1 & 5 \\ 3 & -4 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 1 & 3 \\ -1 & 5 \end{pmatrix}$ $\mathbf{C} = \begin{pmatrix} 7 \\ -4 \end{pmatrix}$ $\mathbf{D} = \begin{pmatrix} 2 & 5 \end{pmatrix}$

(a) Work out each of the following if the answer is possible.
If a calculation is not possible, write "not possible" in the answer space.

(i) **BA**

[1]

(ii) 2**A**

[1]

(iii) **CD**

[2]

(iv) **DC**

[2]

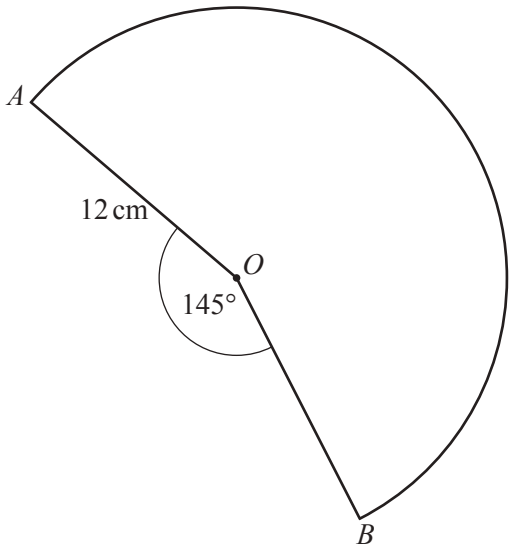
(v) $\mathbf{B}^2$

[2]

(b) Find $\mathbf{B}^{-1}$, the inverse of **B**.

$\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

9



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The diagram shows a sector, centre O, and radius 12 cm.

(a) Calculate the area of the sector.

..... cm^2 [3]

(b) The sector is made into a cone by joining OA to OB.

Calculate the volume of the cone.
[The volume, V, of a cone with base radius r and height h is $V = \frac{1}{3}\pi r^2 h$.]

..... cm^3 [6]

10

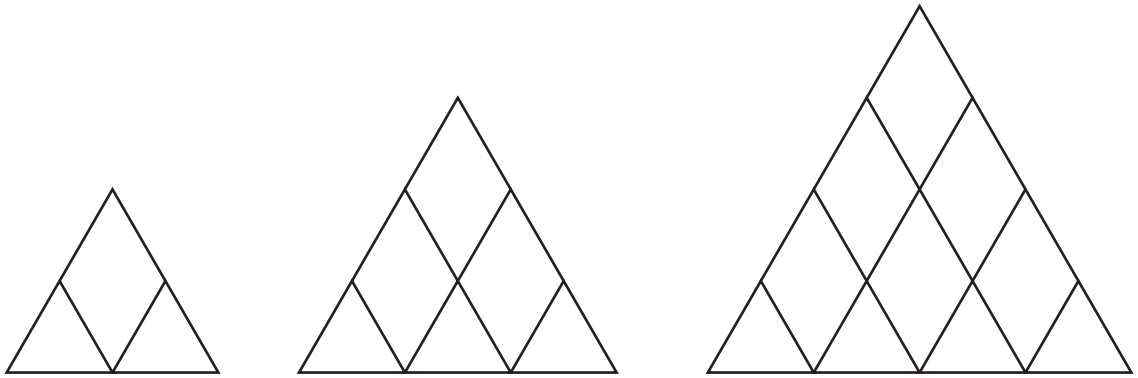

Diagram 1 Diagram 2 Diagram 3

Each diagram is made from tiles in the shape of equilateral triangles and rhombuses.
The length of a side of each tile is 1 unit.

(a) Complete the table below for this sequence of diagrams.

Diagram	1	2	3	4	5
Number of equilateral triangle shaped tiles	2	3	4	5	6
Number of rhombus shaped tiles	1	3	6		
Total number of tiles	3	6	10		
Number of 1 unit lengths	8	15	24		

[6]

(b) **(i)** The number of 1 unit lengths in Diagram n is $n^2 + 4n + p$.

Find the value of p.

$p =$ ..... [2]

(ii) Calculate the number of 1 unit lengths in Diagram 10.

..... [1]

(c) The total number of tiles in Diagram n is $an^2 + bn + 1$.

Find the value of a and the value of b.

$a =$ .....

$b =$ ..... [5]

(d) Part of the Louvre museum in Paris is in the shape of a square-based pyramid made from glass tiles. Each of the triangular faces of the pyramid is represented by Diagram 17 in the sequence.

(i) Calculate the total number of glass tiles on one triangular face of this pyramid.

..... [2]

(ii) 11 tiles are removed from one of the triangular faces to create an entrance into the pyramid.

Calculate the total number of glass tiles used to construct this pyramid.

..... [1]

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